

REMARKS

The Office Action mailed January 28, 2009, has been received and its contents carefully noted. The pending claims, claims 1-12, were rejected. By this Response, claims 2-5 have been amended and claims 6-12 have been canceled. Support may be found in the specification and the claims as originally filed. No statutory new matter has been added. Therefore, reconsideration and entry of the claims, as amended, are respectfully requested.

Objection to the Drawings

The Examiner objected to the Drawings for failing to include reference signs S1 and S2.

Applicants respectfully submit that the amendment to Figure 1, as set forth in Replacement Sheet 1/9, provides reference signs S1 and S2. No statutory new matter has been added by Replacement Sheet 1/9. Therefore, the amendment to the Drawings should be entered and the objection to the drawings should be withdrawn.

Claim Objections

The Examiner objected to the claims for various informalities.

Applicants respectfully urge that the claims, as amended, obviate the claim objections. Therefore, the objection to the claims should be withdrawn.

Rejection under 35 U.S.C. 102(b)

The Examiner rejected claim 6 under 35 U.S.C. 102(b) as being anticipated by Endo (US 6,429,518).

Applicants respectfully submit that this rejection should be withdrawn as moot in view of the cancelation of claim 6.

Rejections under 35 U.S.C. 103(a)

Rejections Moot by Claim Cancelation

The Examiner rejected claims 7-8 under 35 U.S.C. 103(a) as being unpatentable over Endo in view of Gibson (US 20030003765). The Examiner rejected claims 9-12 as being unpatentable over Matsubara (US 6,149,730) in view of Wetzel (US 7,199,046).

Applicants respectfully submit that these rejection should be withdrawn as moot in view of the amendment to the claims.

Rejection of Claims 1-5

The Examiner rejected claims 1-4 under 35 U.S.C. 103(a) as being unpatentable over Endo in view of Gibson. The Examiner rejected claim 5 as being unpatentable over Endo in view of Wetzell.

Applicants respectfully urge that the cited documents, alone or in combination, do not teach or suggest the claimed invention. Specifically, the claimed invention is directed to a method which comprises the following features:

(a) forming on a dielectric film, made of fluorine-added carbon, a protective layer comprising a nitrogen-added silicon carbide film, and

(b) depositing, on the protective layer, a thin film serving as a hardmask made of oxygen-added silicon carbide by a plasma containing active species of silicon, carbon, and oxygen.

In Applicants' preferred, exemplary embodiments, due to features (a) and (b), the SiCN film 93 prevents the active species of oxygen used for depositing the SiCO film 94 from reacting with carbon contained in the fluorine-added carbon film 91. As a result, a degassing from the fluorine-added carbon film 91 can be decreased. See Specification, page 17, lines 32-36. In addition, if a C-F linkage and a Si-O linkage are adjacent to each other, undesirable SiF₄ is generated and sublimates during an annealing process. Features (a) and (b), however, can eliminate such problems by physically separating the SiCO film 41 (See Figures 8(a)-(f)) and the fluorine-added carbon film 40 from each other, by means of the SiCN film 42 as a protective film. See Specification, page 23, lines 14-20.

Endo, Gibson and Wetzell do not, alone or in combination, teach or suggest features (a) and (b) as claimed, or their advantages. As indicated by the Examiner, Endo fails to disclose depositing on a protective layer, a thin film serving as a hardmask made of oxygen-added silicon carbide by a plasma containing active species of silicon, carbon, and oxygen. Endo fails to suggest feature (b) as instantly claimed.

The disclosure of Gibson does not alleviate the deficiencies of Endo. In particular, in paragraph 28, Gibson teaches that an upper barrier layer film (SiCO) 13 is adjacent to a low-k dielectric film 17 (which corresponds to the dielectric film of the instant invention), and that the upper barrier layer film (SiCO) 13 prevents N-H base groups from diffusing into the low-k dielectric film 17. Thus, according to Gibson, the upper barrier layer film (SiCO) 13 has to be adjacent to the low-k dielectric film 17, and the lower barrier layer (SiCN) 11 can not be adjacent to the low-k dielectric film 17. On the other hand, according to the present invention, the dielectric film made of fluorine-added carbon (CF), which does not include Si, can not be adjacent to the hardmask made of oxygen-added silicon carbide (SiCO) and has to be adjacent to the protective layer including the nitrogen-added silicon carbide film (SiCN) in order to (1) decrease the amount of degassing from the fluorine-added carbon film, and (2) avoid sublimation of SiF₄ during the annealing process. In short, according to Gibson, the low-k dielectric film 17 must be adjacent to the barrier layer film 13 (SiCO) and can not be adjacent to the lower barrier layer 11 (SiCN). However, according to the claimed invention, the dielectric film made of fluorine-added carbon (CF) has to be adjacent to the protective layer comprising the nitrogen-added silicon carbide film (SiCN), and can not be adjacent to the hardmask made of oxygen-added silicon carbide (SiCO). For at least these reasons the asserted combination of Endo and Gibson does not result in the claimed invention as a whole.

Applicants respectfully submit that the disclosure of Wetzel fails to alleviate the deficiencies of Endo and Gibson. In particular, Wetzel merely discloses that silicon oxycarbide (SiCO) can be used as the hardmask layer 135. See col. 5, lines 42-43.

Since the cited documents do not teach or suggest features (a) and (b) of the claimed invention, the present invention is unobvious.

Therefore, the rejections under 35 U.S.C. 103(a) should be withdrawn.

Provisional Non-Statutory Double Patenting Rejection

The Examiner provisionally rejected claims 1 and 6 on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 3-4 of copending U.S. Patent Application Serial No. 12/157,795.

Applicants respectfully request that this rejection be held in abeyance until an indication of allowable subject matter.

Request for Interview

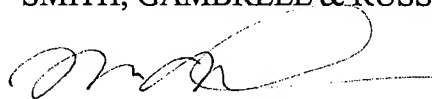
Applicants respectfully request either a telephonic or an in-person interview should there be any remaining issues.

CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Therefore, it is respectfully requested that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

It is not believed that extensions of time are required, beyond those that may otherwise be provided for in accompanying documents. However, in the event that additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. 1.136(a), and any fees required therefor are hereby authorized to be charged to **Deposit Account No. 02-4300, Attorney Docket No. 033082M336.**

Respectfully submitted,
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Date: July 20, 2009

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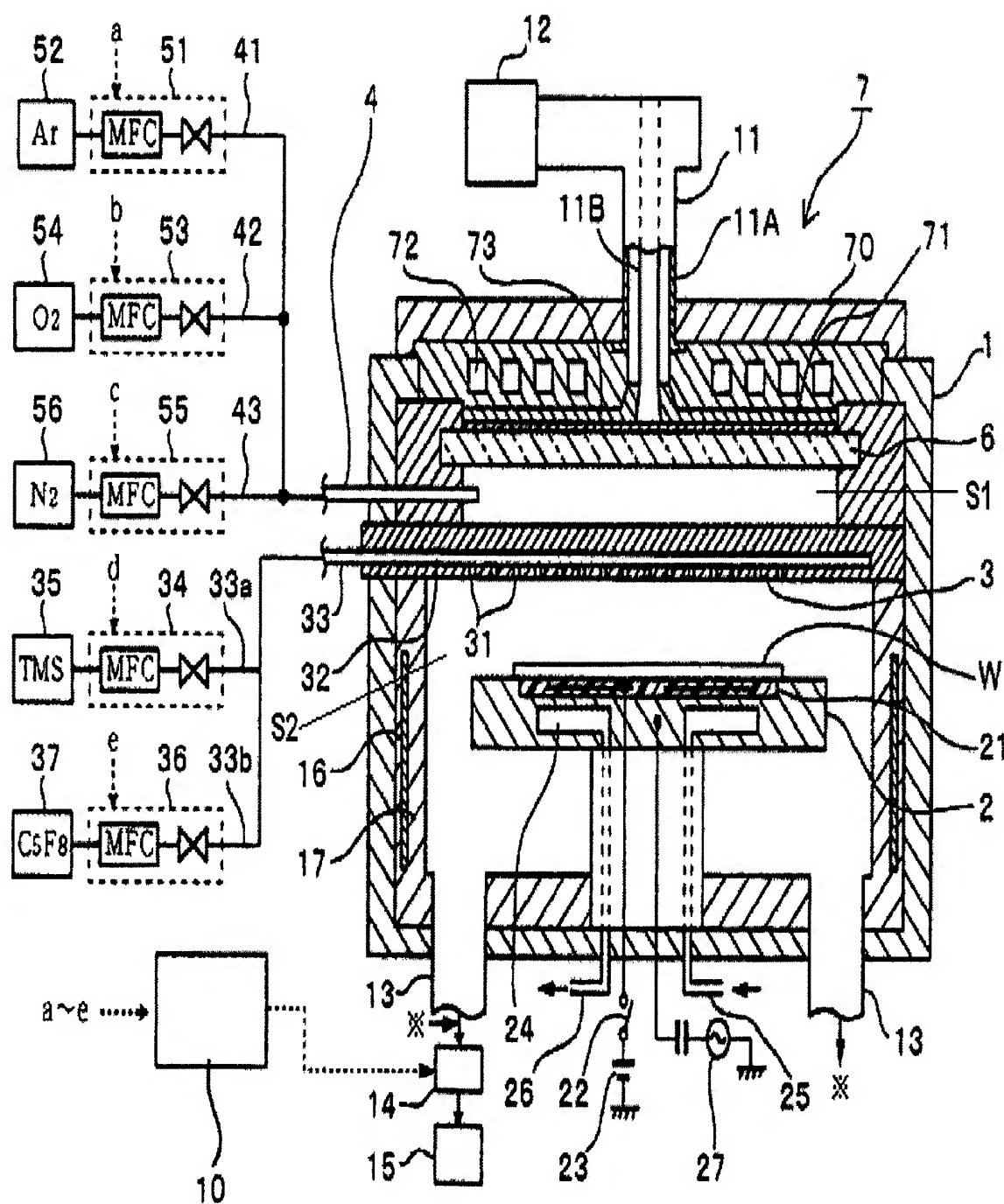


FIG. 1